

WHAT IS CLAIMED IS:

1 1. An apparatus for forming a thermoplastic resin foam
2 comprising:

3 a screw cylinder having a material supply hole arranged
4 near a rear end portion of one end of the screw cylinder and
5 an injection nozzle arranged on a top end portion of the other
6 end of the screw cylinder;

7 a screw, provided in said screw cylinder, rotatably driven
8 in directions of plasticization and injection, said screw
9 corresponding to said screw cylinder and classified as a first
10 metalization portion, a low-pressure portion, and second
11 metalization portion in that order from the rear end portion
12 to the top end portion;

13 a gas supply hole for injecting an inert gas, such as a
14 carbon dioxide gas or a nitrogen gas having, at least in pressure,
15 a pressure equal to or greater than a supercritical pressure
16 or for injecting an inert gas under a supercritical state, said
17 gas supply hole being disposed at a position corresponding to
18 the low-pressure portion of said screw of said screw cylinder;
19 and

20 drive means for driving said screw in the directions of
21 plasticization and injection.

1 2. An apparatus for forming a thermoplastic resin foam as
2 claimed in claim 1, wherein said drive means comprise an

3 electric servomotor.

1 3. A method for forming a thermoplastic resin foam comprising
2 the steps of:

3 plasticizing a thermoplastic resin material by rotatably
4 driving a screw provided drivably in directions of
5 plasticization and injection inside a screw cylinder,

6 injecting melted resin, permeated by an inert gas, into
7 a mold by driving said screw in the direction of injection after
8 having injected the inert gas such as a carbon dioxide or a
9 nitrogen gas having, at least in pressure, a pressure equal to
10 or greater than a supercritical pressure or the inert gas under
11 a supercritical state into said screw cylinder to allow the
12 inert gas to permeate melted resin,

13 wherein an electric servomotor is used as a drive means
14 for driving said screw in the directions of plasticization and
15 injection,

1 4. A method for forming a thermoplastic resin foam as claimed
2 in claim 3, wherein after the step of plasticizing the
3 thermoplastic resin material has been completed, said screw is
4 prevented from retreating by applying brake to said electric
5 servomotor to maintain a pressure at a supercritical pressure
6 or more inside said screw cylinder.

1 5. A method for forming a thermoplastic resin foam as claimed
2 in claim 3, wherein the step of plasticizing the thermoplastic
3 resin material is performed until immediately before the step
4 of injecting the melted resin is initiated.

1 6. A method for forming a thermoplastic resin foam as claimed
2 in claim 3, wherein even after the step of plasticizing the
3 thermoplastic resin material has been completed, said screw is
4 driven at low speeds in the direction of plasticization until
5 immediately before the step of injecting the melted resin is
6 initiated.

1 7. A method for forming a thermoplastic resin foam as claimed
2 in claim 3, wherein when a pressure has dropped below a pre-set
3 value inside said screw cylinder, said screw is driven in the
4 direction of plasticization so as to stop said screw when the
5 pressure becomes equal to or greater than the pre-set value in
6 order to maintain the pressure at a supercritical pressure or
7 more inside said screw cylinder.

1 8. A method for forming a thermoplastic resin foam as claimed
2 in claim 3, wherein when said screw is driven in the direction
3 of plasticization, driving said screw in the opposite direction
4 of plasticization is intermittently combined therewith.

1 9. A method for forming a thermoplastic resin foam as claimed
2 in claim 3, wherein during plasticization, said screw cylinder
3 is provided with micro-vibration in the direction of injection.

1 10. A method for forming a thermoplastic resin foam according
2 to claim 3, wherein said screw corresponds to said screw
3 cylinder and is selected as a first metalization portion, a
4 low-pressure portion, and second metalization portion in that
5 order from a rear end portion to a top end portion of said screw;
6 and further comprising:

7 an inert gas having, at least in pressure, a pressure equal
8 to or greater than a supercritical pressure or an inert gas under
9 a supercritical state is injected into a position corresponding
10 to the low-pressure portion of said screw of said screw
11 cylinder.

1 11. A method for forming a thermoplastic resin foam according
2 to claim 4, wherein said screw corresponds to said screw
3 cylinder and is selected as a first metalization portion, a
4 low-pressure portion, and second metalization portion in that
5 order from a rear end portion to a top end portion of said screw;
6 and further comprising:

7 an inert gas having, at least in pressure, a pressure equal
8 to or greater than a supercritical pressure or an inert gas under
9 a supercritical state is injected into a position corresponding

10 to the low-pressure portion of said screw of said screw
11 cylinder.

1 12. A method for forming a thermoplastic resin foam according
2 to claim 5, wherein said screw corresponds to said screw
3 cylinder and is selected as a first metalization portion, a
4 low-pressure portion, and second metalization portion in that
5 order from a rear end portion to a top end portion of said screw;
6 and further comprising:

7 an inert gas having, at least in pressure, a pressure equal
8 to or greater than a supercritical pressure or an inert gas under
9 a supercritical state is injected into a position corresponding
10 to the low-pressure portion of said screw of said screw
11 cylinder.

1 13. A method for forming a thermoplastic resin foam according
2 to claim 6, wherein said screw corresponds to said screw
3 cylinder and is selected as a first metalization portion, a
4 low-pressure portion, and second metalization portion in that
5 order from a rear end portion to a top end portion of said screw;
6 and further comprising:

7 an inert gas having, at least in pressure, a pressure equal
8 to or greater than a supercritical pressure or an inert gas under
9 a supercritical state is injected into a position corresponding
10 to the low-pressure portion of said screw of said screw

11 cylinder.

1 14. A method for forming a thermoplastic resin foam according
2 to claim 7, wherein said screw corresponds to said screw
3 cylinder and is selected as a first metalization portion, a
4 low-pressure portion, and second metalization portion in that
5 order from a rear end portion to a top end portion of said screw;
6 and further comprising:

7 an inert gas having, at least in pressure, a pressure equal
8 to or greater than a supercritical pressure or an inert gas under
9 a supercritical state is injected into a position corresponding
10 to the low-pressure portion of said screw of said screw
11 cylinder.

1 15. A method for forming a thermoplastic resin foam according
2 to claim 8, wherein said screw corresponds to said screw
3 cylinder and is selected as a first metalization portion, a
4 low-pressure portion, and second metalization portion in that
5 order from a rear end portion to a top end portion of said screw;
6 and further comprising:

7 an inert gas having, at least in pressure, a pressure equal
8 to or greater than a supercritical pressure or an inert gas under
9 a supercritical state is injected into a position corresponding
10 to the low-pressure portion of said screw of said screw
11 cylinder.

2 to claim 9, wherein said screw corresponds to said screw
 3 cylinder and is selected as a first metalization portion, a
 4 low-pressure portion, and second metalization portion in that
 5 order from a rear end portion to a top end portion of said screw;
 6 and further comprising:
 7 an inert gas having, at least in pressure, a pressure equal
 8 to or greater than a supercritical pressure or an inert gas under
 9 a supercritical state is injected into a position corresponding
 10 to the low-pressure portion of said screw of said screw
 11 cylinder.